N86-29349

FSA FUTURE DIRECTIONS

FSA TECHNOLOGY ACTIVITIES IN FY86

JET PROPULSION LABORATORY

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Introduction

- NO NEW INITIATIVES
- MANY SPECIFIC ACTIVITIES TARGETED FOR COMPLETION
- CONTINUED DEVELOPMENT IN INDUSTRY
- EMPHASIS ON TECHNOLOGY TRANSFER
- FURTHER GENERIC RESEARCH IN HIGH RISK ELEMENTS RECOMMENDED

Silicon Material Task

- NO NEW INITIATIVES
- MAJOR PROGRAM OBJECTIVES ACHIEVED
- INDUSTRY DEVELOPMENT OF FBR DEPOSITION TECHNOLOGY UNDERWAY
- TECHNOLOGY TRANSFER COMPLETED
- FURTHER GENERIC RESEARCH IN THE PROGRAM NOT REQUIRED

Silicon Material Task: Technical Accomplishments

- COMPLETED DEVELOPMENT OF SiH_4 PRODUCTION SECTION OF SILICON PROCESS (UNION CARBIDE-CONTRACTOR)
- COMPLETED PILOT PLANT (120 MT/YEAR) DEMONSTRATION OF SILANE PROCESS WHICH INCORPORATES CVD REACTORS (UNION CARBIDE-CONTRACTOR)
- DEMONSTRATED LABORATORY OPERATION OF SiH_4-FBR DEPOSITION
  - OPERATION AT VERY HIGH CONCENTRATIONS (INCLUDING 100% SiH_4) FOR SHORT-TIME RUNS (JPL IN-HOUSE)
  - OPERATIONS WITH 20% SiH_4 FOR EXTENDED-TIME RUNS (UP TO 66 HRS) (UNION CARBIDE-CONTRACTOR)
- DEMONSTRATED TECHNICAL FEASIBILITY OF DICHLOROSILANE CVD PROCESS (HEMLOCK SEMICONDUCTOR)
- SHOWED QUANTITATIVELY THE INFLUENCE OF IMPURITIES ON LIFETIME IN SILICON (WESTINGHOUSE)

Advanced Silicon Sheet Task

- NO NEW INITIATIVES
- MANY ACTIVITIES WILL BE AT VARIOUS LEVELS OF COMPLETION
  - WEB RIBBON DEVELOPMENT AT WESTINGHOUSE AND JPL
  - GENERIC STRESS/STRAIN ANALYSIS
  - GROWTH RELATED DEFECTS/DEVICE EFFICIENCY
- INDUSTRY FUNDING OF SHEET DEVELOPMENT HEALTHY
- STRONG TECHNOLOGY TRANSFER WILL CONTINUE
- FURTHER RESEARCH IN GENERIC RIBBON GROWTH REQUIRED

Advanced Silicon Sheet Task: Remaining Technical Problems

LINEAR GROWTH RATE/AREAL THROUGHPUT

- UNDERSTANDING AND CONTROL OF STRESS AND STRAIN PHENOMENA
  - MEASUREMENT AND UNDERSTANDING OF HIGH TEMPERATURE MECHANICAL PROPERTIES OF SILICON
  - MEASUREMENT AND CONTROL OF TEMPERATURES AND HEAT FLOW IN THE HOT ZONE
  - CHARACTERIZATION OF STRESS AND STRAIN RELATED DEFECTS IN THE SILICON
  - DEVELOPMENT OF A COMPREHENSIVE INTEGRATED ELASTIC/PLASTIC MODEL TO GUIDE HOT ZONE ENGINEERING

SILICON SHEET QUALITY

- UNDERSTANDING THE RELATIONSHIP BETWEEN GROWTH-RELATED DEFECTS AND FABRICATED DEVICE PROPERTIES (IN CONJUNCTION WITH THE DEVICE AND MEASUREMENTS TASK)
- UNDERSTANDING THE IMPORTANCE OF THE STRUCTURE (ESPECIALLY THE TWIN PLANES IN WEB) ON THE GROWTH PROCESS AND, ULTIMATELY, DEVICE PERFORMANCE
- INTERFACE STABILITY/IMPURITY REDISTRIBUTION

Device Research Task

- NO NEW INITIATIVES
- SPECIFIC ACTIVITIES TARGETTED FOR COMPLETION
  - MODEL DEVELOPMENT TO BE COMPLETED
  - PROOF-OF-CONCEPT DEMONSTRATION PHASED OUT
- HIGH EFFICIENCY DEVICE TECHNOLOGY NOT IMPLEMENTED IN INDUSTRY
- TECHNOLOGY EXCHANGE THROUGH RESEARCH FORUMS
- FURTHER RESEARCH STRONGLY RECOMMENDED
  - SURFACE/INTERFACE LOSSES
  - BULK LOSSES/SHEET QUALITY
  - MEASUREMENT TECHNIQUES

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Device Research Task: Remaining Problems

BULK LOSS

- BULK RECOMBINATION/PASSIVATION
  - MECHANISMS
- QUALITY OF SILICON SHEET
  - GROWTH/PROPERTIES RELATIONSHIPS

SURFACE LOSS

- SURFACE RECOMBINATION/PASSIVATION
  - FUNDAMENTAL UNDERSTANDING
  - MEASUREMENTS
  - PROCESS DEVELOPMENT

MODELING

- VERIFICATION OF HIGH-EFFICIENCY DEVICE DESIGNS AND SENSITIVITY ANALYSIS

MEASUREMENTS

- MATERIALS AND DEVICE PARAMETERS FOR HEAVILY DOPED FRONT SURFACE LAYER

Process Research Area

- NO NEW INITIATIVES
- ACTIVITIES TARGETED FOR COMPLETION
  - EXCIMER LASER PROCESSING
  - MOD METALLIZATION
  - LIQUID DOPANT
  - DEVELOPMENT OF LOW-COST APPROACHES
- INDUSTRY HAS ADOPTED LOW-COST PROCESSES
- TECHNOLOGY EXCHANGE OF HIGH EFFICIENCY PROCESSES EMPHASIZED
- GENERIC RESEARCH FOR HIGH EFFICIENCY DEVICE PROCESSES RECOMMENDED